

FRESHWATER FISH REMAINS FROM THE CLARNO FORMATION OCHOCO MOUNTAINS OF NORTH-CENTRAL OREGON

By Ted M. Cavender
Museum of Zoology, University of Michigan

Introduction

Recent collecting at exposures of carbonaceous shale in the Clarno Formation west of Mitchell, Oregon has produced a small quantity of fragmentary fish material representing an undescribed fauna. The fossils were found in the Ochoco Mountains along

U.S. Highway 26 where it crosses the mountains near Ochoco Summit. The fossil-bearing site in the black shales is named the Ochoco Pass locality and the fish remains described herein are referred to the Ochoco Pass local fauna. Although this fauna, at present, is a small one, it holds considerable interest from two standpoints. First, it is an older Tertiary fish fauna of later age than the famous middle Eocene Green River fauna, but earlier than the more numerous middle Tertiary fish faunas of western North America.

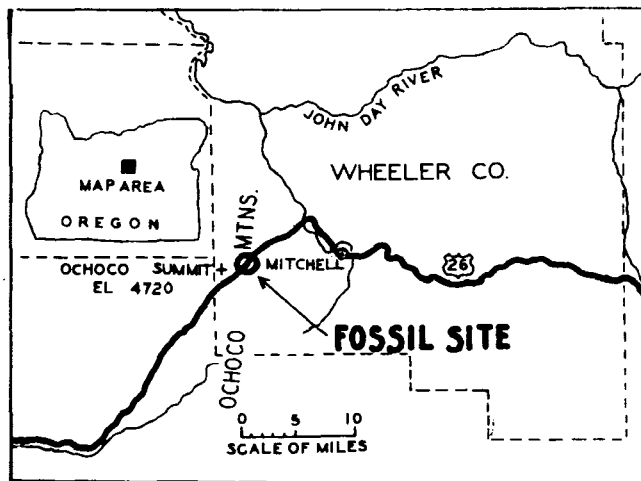


Figure 1. Map showing location of the Ochoco Pass locality.

Second, the fossils may help to shed some light on the depositional environment of the Ochoco Pass black shales. The shales at one time or another have been regarded as marine sediments (Pigg, 1961, p. 61).

This paper is intended as an initial systematic account of the fish remains at the Ochoco Pass locality. At present, the known fossil fish material is so scant and poorly preserved that only tentative identifications are possible. Considerable effort has been made to compare the Ochoco Pass fossils with pertinent forms previously described from early to middle Tertiary deposits in North America, and with similar Recent forms.

Of the Ochoco Pass specimens I have studied, one of the first to be collected and recognized as fish was loaned to me by its collector, Margaret Steere, geologist for the State of Oregon Department of Geology and Mineral Industries. The bulk of

material and some of the best specimens were collected during several visits to the locality in 1963 and 1966 by Lee Jenkins of Hood River, Oregon. I am very grateful to the latter for his considerable contribution to this project. Other specimens were collected in August 1966 by a field party consisting of Michael Uhtoff, Michael Lappé, Lee Jenkins, and the author.

Location and Geology

All of the fossil fish material came from a deep road cut on U.S. Highway 26, 13.5 miles west of Mitchell, in the $W\frac{1}{2}$ sec. 17, T. 12 S., R. 20 E., Wheeler County, Oregon. This road cut is approximately 2.7 miles northeast of Ochoco Summit. The fossil site is indicated on the map (fig. 1). Good exposures of carbonaceous shale occur in the vertical cuts on both sides of the road. The fossils were found on slabs of shale pried loose from the walls in the basal 10 feet of the road cut (fig. 2).

The geology in the vicinity of the fossil fish locality is summarized by the Oregon Department of Geology and Mineral Industries as follows:

The Ochoco Pass locality is underlain by the Clarno Formation, which is widely distributed throughout central Oregon. According to Wilkinson (1959), the formation is composed largely of terrestrial volcanic rocks having similar lithologies from place to place but representing variable times of deposition. Of particular importance in the Clarno are lenses of tuffaceous sediments containing fossil plants and a mammalian fauna. The formation rests unconformably on Cretaceous marine beds in the vicinity of Mitchell and is unconformably overlain by the John Day Formation of late Oligocene to early Miocene age. This relationship, in addition to fossil studies and several potassium-argon dates, places the age of the Clarno as Eocene to early Oligocene.

In respect to the stratigraphic horizon occupied by the fossil fish described in this paper, the particular shale bed is in the lowest of three Clarno units mapped by Swarbrick (1953) in an unpublished master's thesis on the geology of this area. Swarbrick (p. 36-44) writes: "Unit 1 of the Clarno Formation consists of extensive andesitic mudflows, volcanic flow breccia, and localized leaf-bearing tuffs and tuffaceous sediments. The sediments include interbedded tuffaceous, carbonaceous shale and sandstone, overlain by tuffaceous volcanic cobble conglomerate."

"Total thickness of unit 1 is about 2100 feet of which 600 feet are tuffaceous sediments and 1500 are volcanic breccia and andesitic mudflow."

The younger Clarno rocks in the area mapped by Swarbrick consist of unit 2, basaltic flows and flow breccia; and unit 3, local dacite flows.

Preservation of Fossils

Most of the fossils are disarticulated fish bones and scales, some of which are fragmented. The bone is usually in the form of a thin, carbonaceous film, but typically a full imprint of the bone is preserved. The very fine surrounding sediment is pitch black to dark gray and much compacted, forming dense shale layers that fracture conchoidally. Some of the rock resembles a mudstone. Smooth fracture (shear) planes also are apparent at angles to the bedding planes. The shale layers are so broken that only small pieces could be removed from the outcrop.



Figure 2. Above: Road cut, Ochoco Pass locality. Individuals approximately opposite site of fish beds; looking northeast. Below: Closeup showing fish-scale horizon where individuals are working.

Methods of Study

The specimens were prepared for study by removing the carbonized bone. Latex casts were then made from the resulting imprints. This technique produces a fairly good duplication of the original bone. Ammonium chloride was used to highlight surface features on the casts which were stained black by means of India ink mixed with the liquid latex. Photographs were made of the casts using a 35-mm Miranda single-lens reflex camera, bellows attachment and 50-mm Soligor lens, incandescent lighting or electronic flash, and Plus-X film.

I have made full use of the osteological collections of the University of Michigan Museum of Zoology (UMMZ) for making comparisons with the various fossil fish bones. The abbreviation "SL" means standard length, which is the distance from the most anterior part of a fish's snout to the base of its caudal fin.

The scale terminology is that of Lagler (1947). Except where stated, the Ochoco Pass fossils are housed in the University of Michigan Museum of Paleontology (UMMP). Comparative fossil material studied is housed in the Harvard Museum of Comparative Zoology (MCZ), the American Museum of Natural History (AMNH), the United States National Museum (USNM), and the National Museum of Canada (NMC).

Paleontological Descriptions

Amiidae (bowfins)

cf. *Amia* Linnaeus

Plate I, 7. Plate II, 2 and 3.

Material -- 15 isolated scales, most of them complete; the largest is 16 mm, the smallest is 6 mm long.

Remarks -- Among the scales of the living freshwater fishes of North America, those of *Amia calva* are very distinctive (Lagler, 1947). Scales of fossil *Amia*, including those from the Ochoco Pass locality, differ very little from the scales of the Recent bowfin. *Amia* or amiid scales are known from freshwater deposits extending, in age, through much of the Tertiary of western North America. These deposits include the Eocene Bridger Formation, Wyoming (Cope, 1884), Eocene Green River shales (Yale Peabody Museum No. 3009), Eocene Horsefly River beds of British Columbia (NMC collections), Oligocene Florissant Lake Beds, Colorado (Cope, 1884), Oligocene Ruby shales, Montana (UMMP collections), and Oligocene Grant shales, Montana (UMMP collections). For the age determinations applied to the last three fossil-bearing deposits, I have referred to the following authors: MacGinitie (1953) - Florissant Lake Beds; Becker (1961) - Ruby shales; and Becker (1962) - Grant shales.

Hiodontidae (mooneyes)

cf. *Hiodon* Leseur

Plate I, 8 and 9. Plate II, 9.

Material -- several isolated scales.

Remarks -- The existence of a hiodontid in the Ochoco Pass fauna is based on identification of scales alone. The scales illustrated here, when compared with those of

Hiodon tergisus and Hiodon alosoides, show no marked differences. The scale of Hiodon possesses around 10 to 15 basal radii, the lateral basal corners are strong, the focus is apical in position and transversely ovoid in shape, the circuli are very fine, and a few faint, incomplete radii are usually observable in the apical field. Most Hiodon scales are not symmetrical but have one side longer than the other. Some of the fossil scales show this character, also.

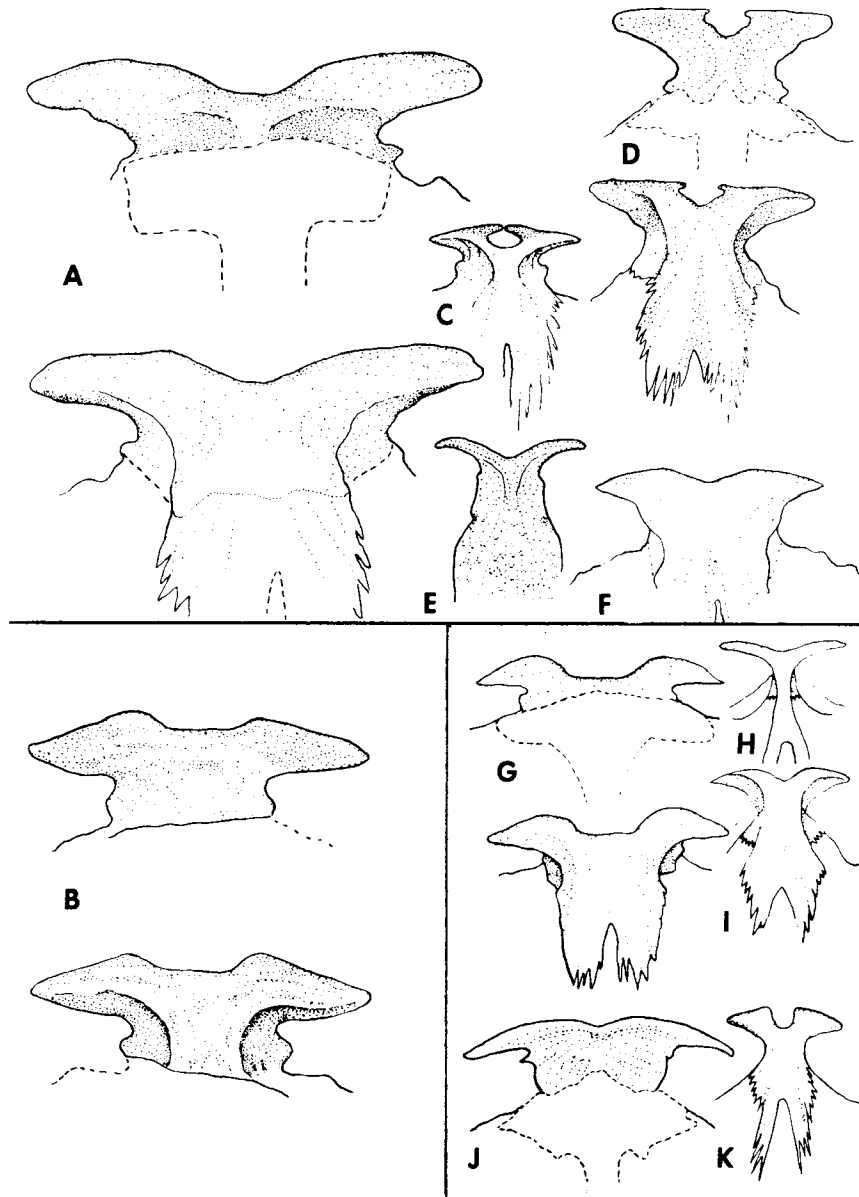
Siluriformes (catfishes)
Family: indeterminate
Plate IV, 1-3

Materials -- a nearly complete supraethmoid, broken left cleithrum, and a complete (right?) pelvic bone.

Remarks -- The bones in question are not readily assignable to any New or Old World catfish family. Catfish in general have a number of very characteristic skeletal elements, two of which are the supraethmoid of the skull and the cleithrum of the pectoral girdle. Unfortunately, in this case, where the supraethmoid and cleithrum are disarticulated and broken, taxonomic determination even to family is exceedingly difficult or impossible. Tilak (1963b) found that the complete pectoral girdle is a useful systematic character at the family level in siluriforms and the same appears to be true of the ethmoid region. Figure 3 gives a general idea of the form of the supraethmoid in a few fossil and Recent catfishes. A shallow and broad anterior notch in the supraethmoid is found in many siluriforms, usually where the premaxillary supporting processes are well developed. The deeper, partly enclosed, notch of Ictalurus (Ictaluridae) (fig. 3D) is repeated in Mystus planiceps (Bagridae), (fig. 3C).

The catfish supraethmoid from the Ochoco Pass locality (fig. 3B; plate IV, 1) has the broad, shallow notch in the anterior margin. In this character, it resembles somewhat the ictalurid Pylodictis olivaris, and, among the North American fossils, "Ameiurus" primaevus Eastman (1917), fig. 3F, and "Rhineastes" sp. (MCZ 8500, fig. 3A). Dorsally, the supraethmoid is constricted between the nasal capsules into a fairly narrow bridge connecting the premaxillary supporting processes to the frontals. This ethmoid bridge is excavated at each side, forming the mesial walls of the nasal capsules as in Ictalurus. It should be noted for comparative purposes that, posteriorly, the supraethmoid in Ictalurus covers, in part, the anterior extension of the brain case into the ethmoid region (Starks, 1926). Tilak (1965) stated that such an anterior cranial cavity is characteristic of most siluriforms with the main exception of the Ariidae. The anterior portion of the supraethmoid consists of the processes (mentioned above) which are large and directed laterally. To these are attached, ventrally, the premaxillary tooth plates. In the possession of a constriction between the nasal capsules in combination with lateral excavation, the Ochoco Pass supraethmoid resembles that of Ictalurus furcatus (fig. 3D) and a number of Old World catfishes. "Ameiurus" primaevus does not have this constriction and "Rhineastes" sp. (MCZ 8500) shows only a slight indication of such. Underneath the constriction, the Ochoco Pass supraethmoid (mesethmoid) is expanded into a broad oval plate of bone that forms a seat for the head of the vomer and also sutures, posteriorly, with the anterior end of the parasphenoid. Rhamdia (Pimelodidae) does not have such a noticeable expansion of the supraethmoid, nor do the ariids, Arius (Galeichthys) and Potamarius. The ventral supraethmoid plate is well defined in ictalurids.

The Ochoco Pass cleithrum (plate IV, 3) consists only of the middle portion of



the bone; both the anterior and dorsal extensions are missing. There is a strong humeral process. Large confluent ridges cover the lateral surface of the cleithrum.

Of particular importance is the single pelvic bone. Although it resembles that of a number of the Old World catfishes of Europe and Asia (fig. 4), it can be distinguished from the pelvic bones of the Recent North American ictalurids. The characters I have stressed in a comparison of pelvic bones from a limited number of species belonging to seven catfish families are the presence (however weak) of an ossified posterior ischial process (Weitzman, 1962) -- also found in other Ostariophysi:

Figure 3. Comparison of siluroid supraethmoids, fossil and Recent (dorsal aspect except where stated): A. "Rhineastes" sp. MCZ 8 500, Eocene Bridger Basin, Wyo., ventral aspect above, dorsal aspect below, X1.4. B. Indet. UMMZ V56361, Ochoco Pass locality, Oregon, ventral aspect above, dorsal below, X2.2. C. Mystus planiceps (Bagridae) UMMZ 15568 5, SL 205mm, Sumatra, X1.2. D. Ictalurus furcatus (Ictaluridae) UMMZ 169031-S, SL 327 mm, Mo., ventral aspect above, dorsal below, X1.5. E. Clarius lazera (Clariidae) UMMZ 169015-S, SL 189mm, Egypt, X2.7. F. "Ameiurus"primaevus? AMNH 9499, Eocene Green River Formation, Wyo., X1.8. G. Parasilurus asotus (Siluridae) uncat. spec. (J-66), SL 405mm, Japan, ventral aspect above, dorsal below, X1.4. H. Rhamdia guatemalensis (Pimelodidae) UMMZ 178542-S, Mexico, X1.5. I. Pelteobagrus nudiceps (Bagridae) UMMZ 183856-S, SL 167mm, Japan, X2.4. J. Pangasius micronemus (Schilbeidae) UMMZ 186691-S, SL 315mm, Thailand, ventral aspect, X1.4. K. Arius felis (Ariidae), UMMZ 179147-S, SL 192mm, Fla., Gulf of Mex., X1.3.

Characidae, Cyprinidae, Catostomidae -- and the form and relative proportions of the posterior margin. Those catfishes that typically have six or close to six pelvic rays in each fin (five of the seven families: Bagridae, Schilbeidae, Pimelodidae, Ariidae, Clariidae [Regan, 1911]) possess a short, nearly straight articular surface along the posterior margin for seating the pelvic fin rays. Those catfishes with typically more than seven pelvic rays in each fin (Ictaluridae and Siluridae: Silurus, Parasilurus, Kryptopterus, Wallagonia) possess wide, somewhat rounded, posterior margins, that are uninterrupted by notches and do not give rise to any kind of ossified projection at their postero-mesial corners. Although not illustrated, the Plotosidae, an Old World, largely marine, family can also be placed in this category. Except for these last three families, and possibly some of the Eocene Green River forms, all the others included in this comparison (along with the Ochoco Pass catfish) have pelvic bones with ossified ischial processes variously developed. Not enough Recent specimens have been examined to determine whether the rounded posterior margin and lack of an ossified ischial process are correlated with a high number of pelvic fin rays or reflect an anatomical specialization of the pelvic region associated with reproduction (or both may be linked together). Use of the pelvic fins by species of ictalurids in tending their eggs has been described by Breder (1935). Similarity in pelvic structure may indicate a genetic relationship (Tilak, 1963a, has allied the Siluridae to the Plotosidae). The number of rays is known to vary within some currently defined family groups, for example, from 5 to 8 in both the Bagridae and Pimelodidae, 6 to 14 in the Siluridae, and also within a genus, for example, 6 in Pangasius larnaudii, 8 in Pangasius micronemus.

The Ochoco Pass pelvic bone appears to have the short posterior (articulating) margin for seating the pelvic fin rays. Thus it is unlike the typical ictalurid condition.

Catostomidae (suckers)
Gen. and sp. indet.
Plate III, 4-7.

Material -- a small right opercle, right quadrate, fragment of a pharyngeal arch, left interopercle, incomplete basioccipital, and numerous scales.

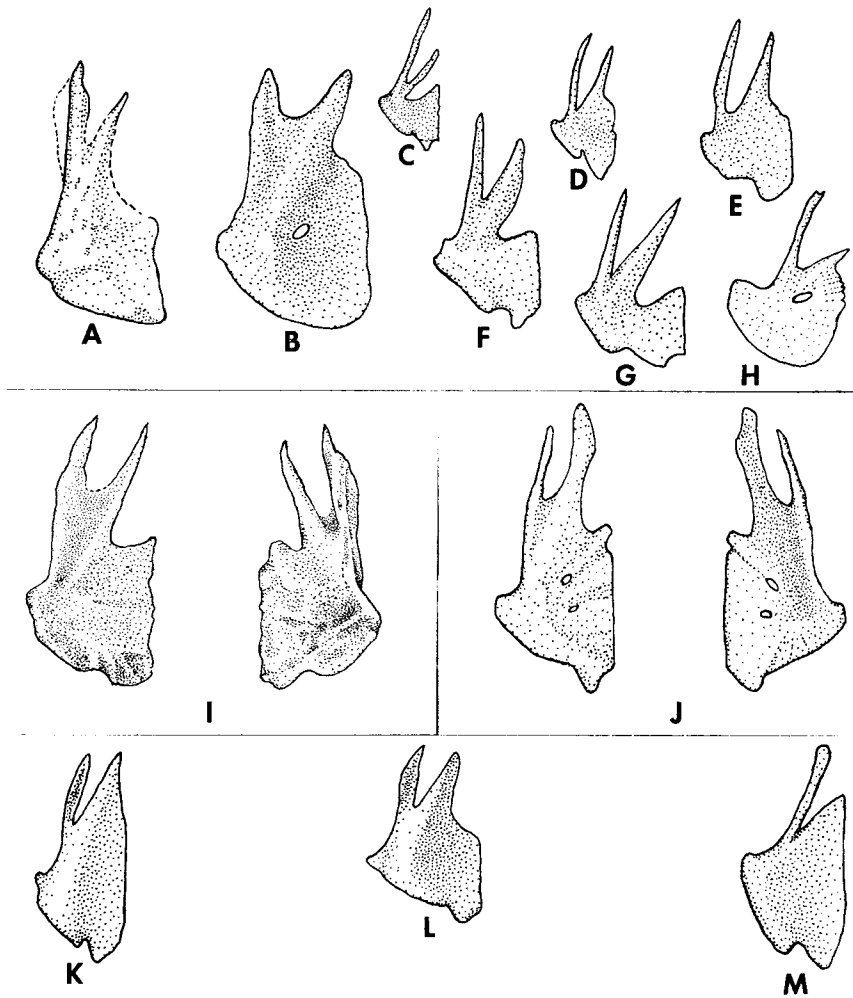


Figure 4. Comparison of siluroid right pelvic bones, ventral aspect except where stated: A. Undescribed species, AMNH 6888, SL 143mm, Eocene Green River Fm., Wyo. X4. B. *Ictalurus punctatus* (Ictaluridae) UMMZ 186239-S, SL 370mm, Va., X1.5. C. *Clarias lazera* (Clariidae) UMMZ 166654, SL 159mm, Egypt X1.6. D. *Rhamdia guatemalensis* (Pimelodidae) UMMZ 184738-S, SL 173mm, Mexico, X1.3. E. *Arius felis* (Ariidae) UMMZ 179147-S, SL 192mm, Fla., X1.3. F. *Pelteobagrus nudiceps* (Bagridae) UMMZ 183855, SL 112mm, China, X2.8. G. *Mystus planiceps* (Bagridae) UMMZ 155685, SL 205mm, Sumatra, X1.6. H. *Parasilurus asotus* (Siluridae) uncat. spec. (J66-), SL 405mm, Japan, X1.6. I. Indet. UMMP V56360, Ochoco Pass locality, Ore., ventral aspect to left, dorsal to right, X3. J. *Pangasius micronemus* (Schilbeidae) UMMZ 186691-S, SL 315mm, Thailand, ventral aspect left, dorsal to right, X1.4. K. *Bagroides macropterus* (Bagridae) UMMZ 186765, SL 163mm, Thailand, X2. L. *Leiocassis siamensis* (Bagridae) UMMZ 186722, SL 80mm, Thailand, X3. M. *Pseudopimelodus zungaro* (Pimelodidae) UMMZ 66312, SL 123 mm, Bolivia, X2.

cf. Amyzon Cope
Plate I, 1,4; Plate II, 1; Plate III, 1-3.

Referred material -- left opercle, left frontal, right dentary, scales.

Remarks -- Study of the scales indicates that more than one kind of sucker is represented in the collection. Scales (plate I, 1,4; plate II, 1) are typical of the "Amyzon type" and can be duplicated in the numerous Amyzon scales from the Oligocene Grant lake shales of Montana (UMMP collections). This type of scale, from the flank region of the body, is characterized by width as great as or greater than the length, the focus is typically basal in position, there are as much as a dozen fine basal radii, strong primary radii in the apical field (with more numerous and weaker secondary radii in older scales), well-defined lateral basal corners that are marked interiorly by the shape of the circuli, and numerous fine circuli (ridges) that thicken slightly, are more widely spaced, and become fluted in the apical field*. The Amyzon scale differs from scales of all Recent catostomids in the above combination of characters and is particularly distinctive in its basally positioned focus. In this latter feature, it agrees with scales of some of the Old World cyprinids -- especially certain species of Leuciscus.

A second type of sucker scale (plate I, 5,6; plate II, 4) represented in the Ochoco Pass locality resembles the "Amyzon type" except that it is (1) proportionally not as deep as long, (2) has a more centrally positioned focus, (3) the basal radii are more numerous, and (4) the lateral basal corners are not as well defined, some being almost rounded. Besides the scales, a left opercle (plate III, 2) appears to belong to the genus Amyzon and resembles some of the opercles found with Amyzon remains from the Oligocene Florissant Formation, Colorado, and from the Grant lake shales, Montana. The dentary (plate III, 3) resembles that of Amyzon brevipinne (Lambe, 1906) and the frontal is close to that of a second deeper bodied Amyzon species, illustrated (but misidentified as Amyzon commune Cope) by Lambe (1906) from the Horsefly River locality, British Columbia. Figure 5 compares the Ochoco Pass frontal with frontals of Amyzon and some Recent catostomids. In general, these frontals fall into two groups. One has a projecting postorbital process and notch in the orbital rim to seat the supraorbital bone; this group contains Amyzon, Ictiobus, and Carpiodes. The other group has no projecting postorbital process of the frontal, no supraorbital bone, and the orbital rim nearly parallels the midline of the skull. Catostomus, Moxostoma, Erimyzon and Hypentelium form the second group. Cycleptus, Myxocyprinus and Minytrema are somewhat intermediate since they have a supraorbital, but no well-developed postorbital process on the frontal.

Discussion

The three identified fish families present in the Ochoco Pass fauna: Amiidae, Hiodontidae, and Catostomidae, as well as an included (but as yet unidentified) catfish family, are, to my knowledge, not known together in any other Eocene or Oligocene fish fauna from western North America. A fossil mooneye is unknown from the

* Fragments of this same type of sucker scale, or one very similar to it, were collected and sent to me by Lee Jenkins from an outcrop of leaf-bearing mudstone on Gray Butte in Jefferson County, Oregon.

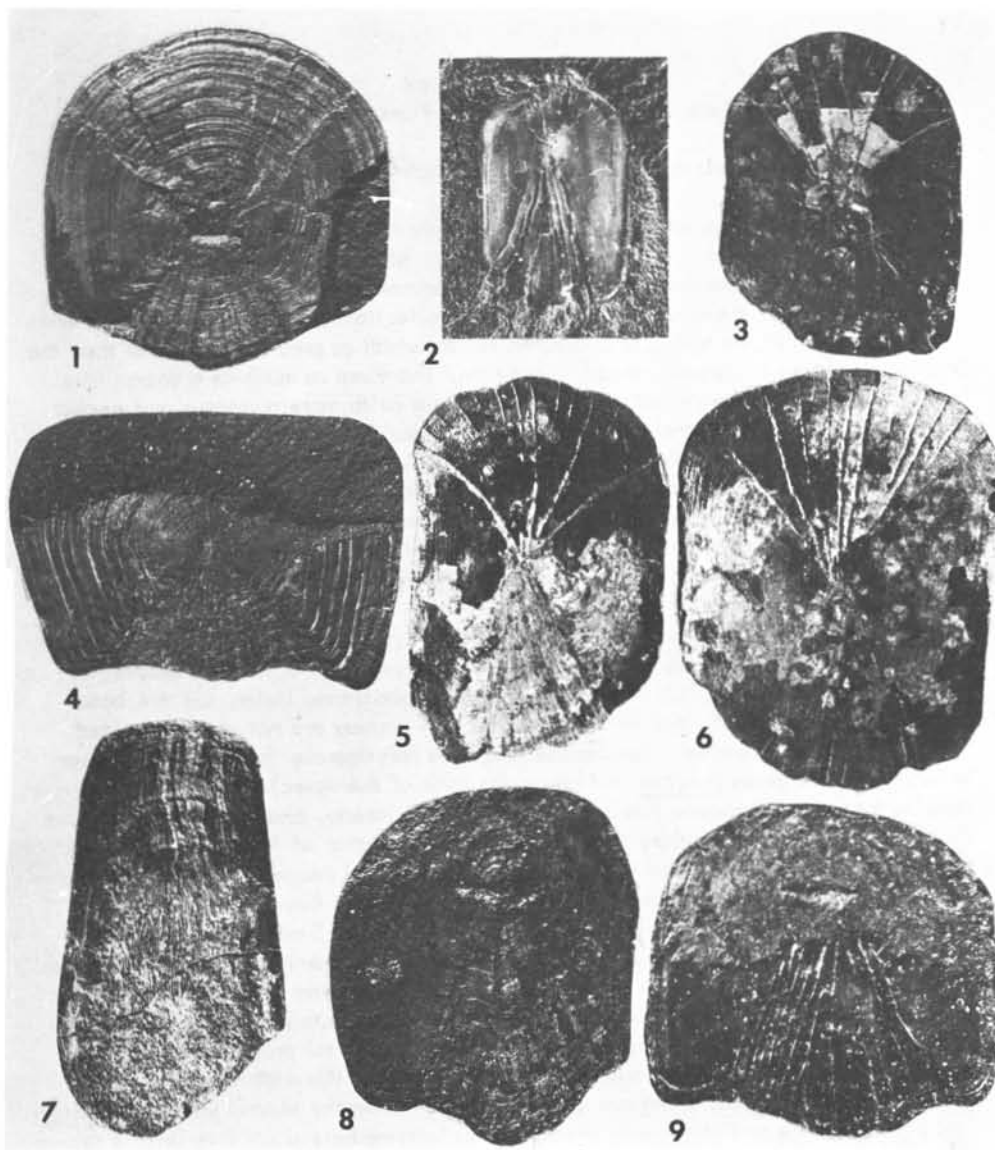


Plate I. Isolated scales from Ochoco Pass locality, Ore.: 1) regenerated catostomid scale, cf. *Amyzon*, UMMP V 56350, X5. 2) Indet. scale, possibly a hiodontid, UMMP V56374, X2. 3) regenerated catostomid scale, Oregon Dept. Geology and Mineral Industries, X3.5. 4) catostomid scale, apical field missing, cf. *Amyzon* UMMP V56347, X4.4. 5) catostomid scale, Oregon Dept. Geol. and Min. Ind., X4.4. 6) catostomid scale, Oregon Dept. Geol. and Min. Ind., X4.6. 7) regenerated amiid scale, cf. *Amia* UMMP V56363, X4. 8) hiodontid scale, cf. *Hiodon* UMMP V56368, X5.9. 9) hiodontid scale, cf. *Hiodon*, UMMP V56370, X7.8.

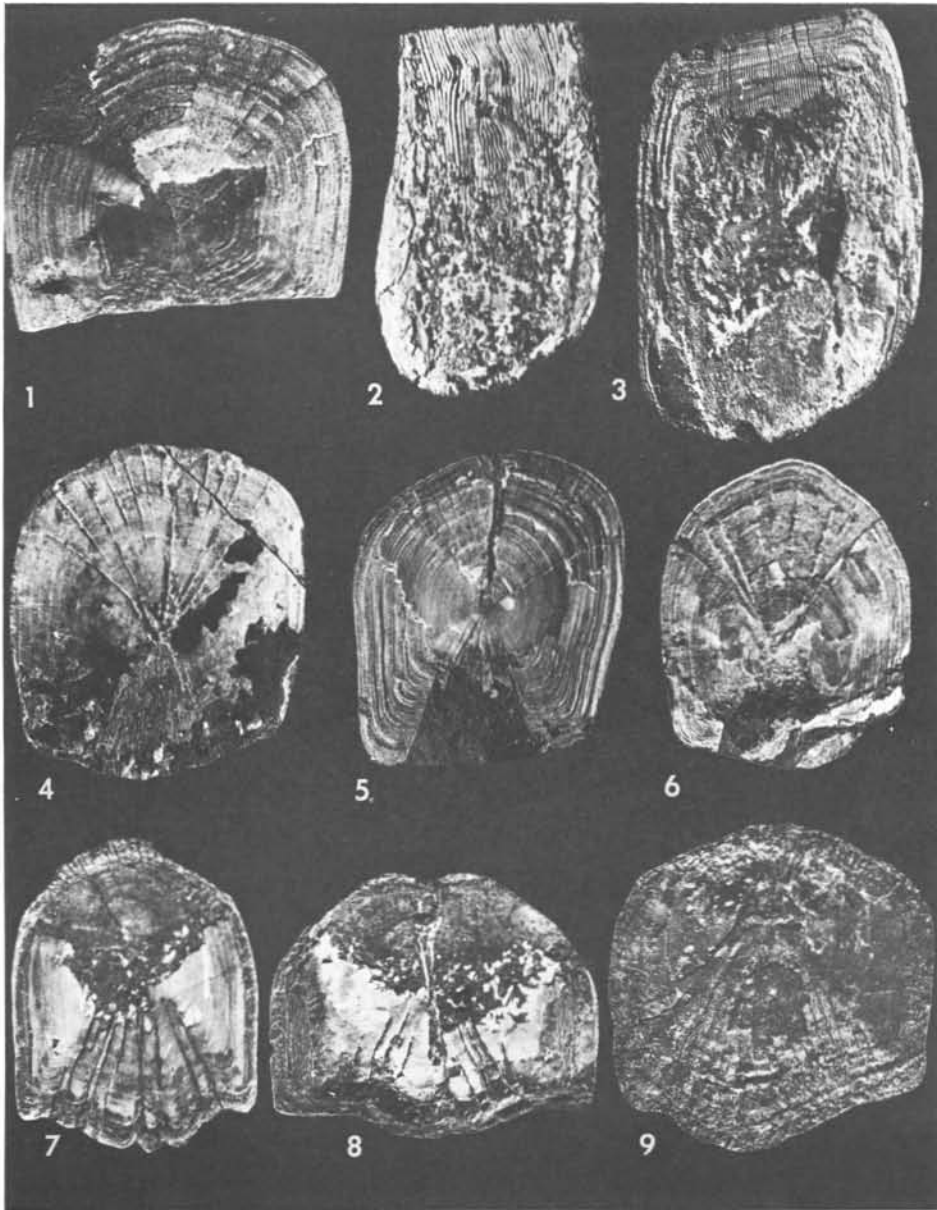
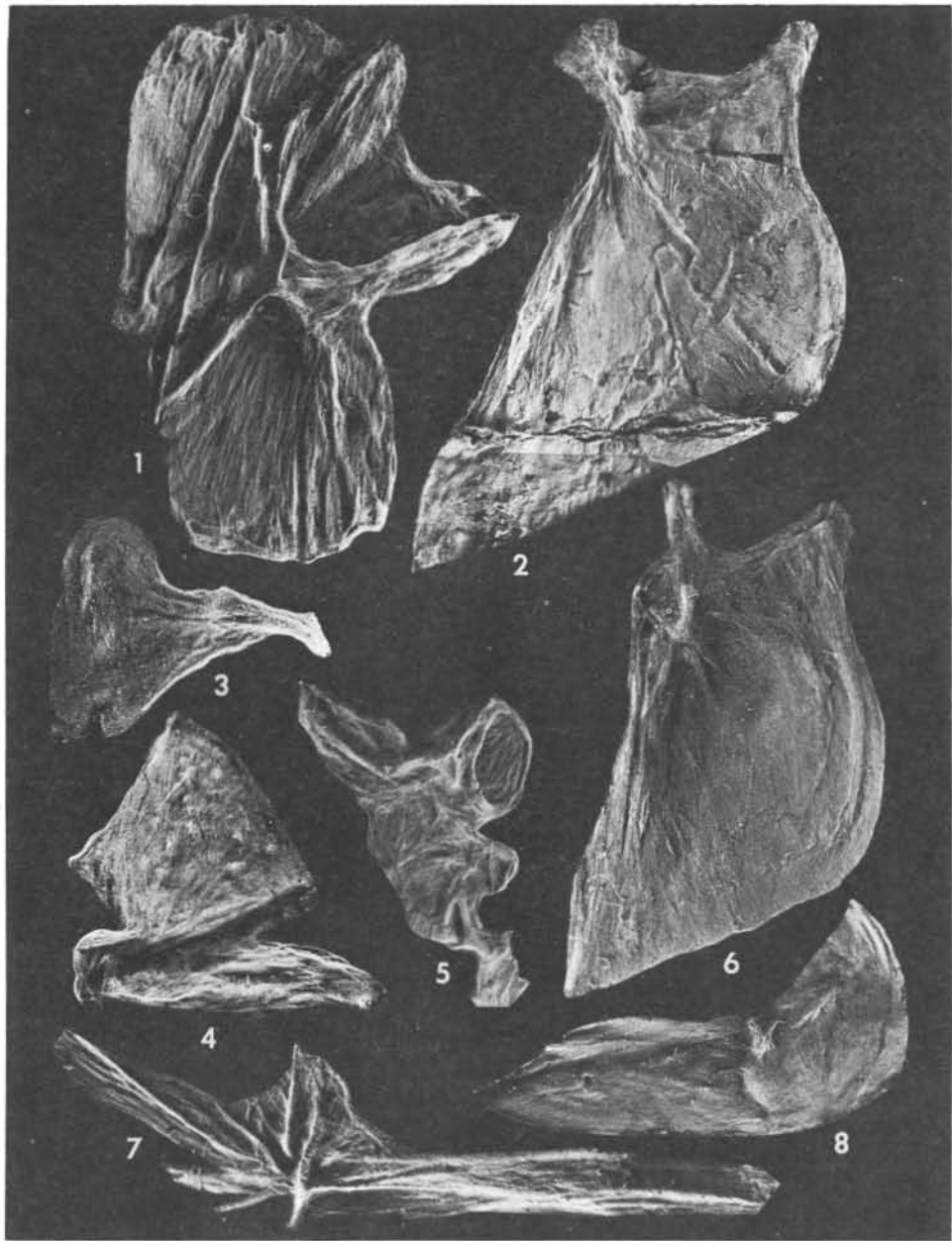


Plate II. Isolated scales from Ochoco Pass locality, Ore.: 1) catostomid scale, cf. Amyzon UMMMP V56358, X4.3. 2) regenerated amiid scale, cf. Amia, UMMMP V56364, X8.2. 3) regenerated amiid scale, cf. Amia, UMMMP V56366, X3.8. 4) catostomid scale, Oregon Dept. Geol. and Min. Ind., X3.8. 5) catostomid scale, UMMMP V56357, X4. 6) catostomid scale, cf. Amyzon, UMMMP V56351, X6.6. 7) Indet. scale, possibly a hiodontid, UMMMP V 56375, X6.5. 8) Indet. lateral line scale, possibly a hiodontid, UMMMP V56371, X5.5. 9) hiodontid scale, cf. Hiodon, UMMMP V56369, X6.



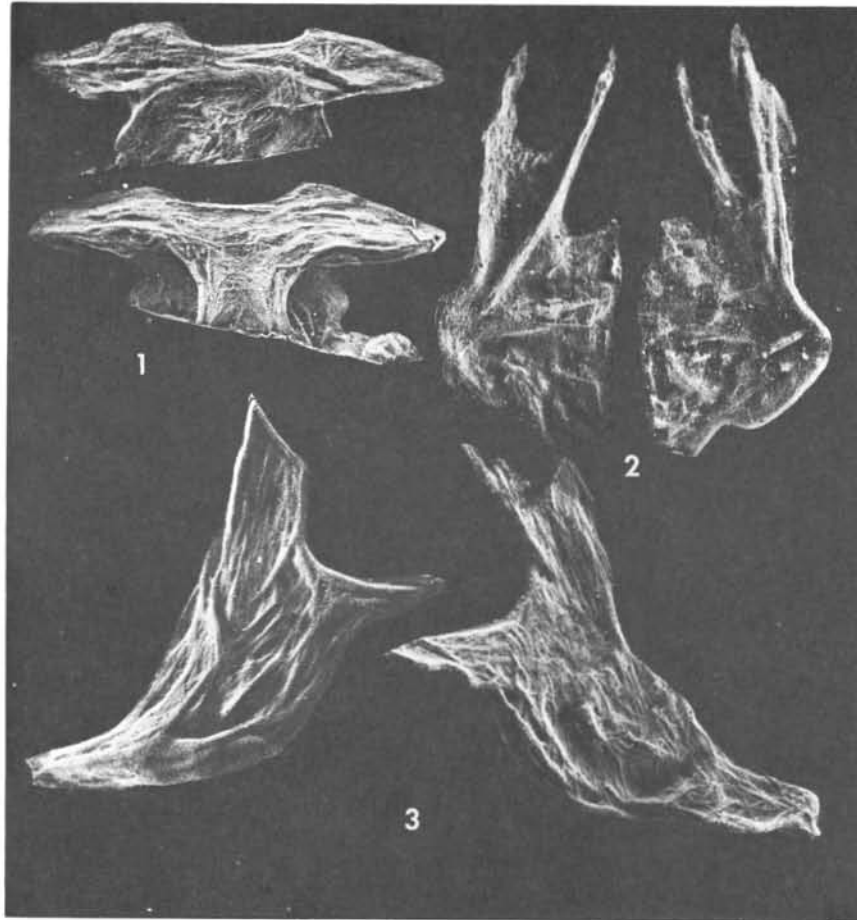


Plate III. Isolated catostomid skull elements from Ochoco Pass locality, Ore.

- 1) left frontal, ventral aspect, cf. *Amyzon*, UMMP V56341, X2.7 2) left opercle, cf. *Amyzon*, UMMP V56346, X1.5. 3) right dentary, cf. *Amyzon*, UMMP V56345, X3.8. 4) right quadrate, mesial aspect, gen. and sp. indet., UMMP V56354, X2.9. 5) incomplete basioccipital, gen. and sp. indet., UMMP V56356, X3.2. 6) right opercle, mesial aspect, gen. and sp. indet., UMMP V56344, X3. 7) parasphenoid, gen. and sp. indet., UMMP V56343, X3.8. 8) left interopercle, gen. and sp. indet. UMMP V56355, X3.9.

Plate IV. Isolated siluroid skeletal elements from Ochoco Pass locality, Ore.

- 1) supraethmoid, ventral aspect above, dorsal below, UMMP V56361, X2.7. 2) right pelvic bone, ventral aspect to left, dorsal to right, UMMP V56360, X4.5. 3) left incomplete cleithrum, lateral aspect at left, mesial at right, UMMP V56362, X3.2. (above)

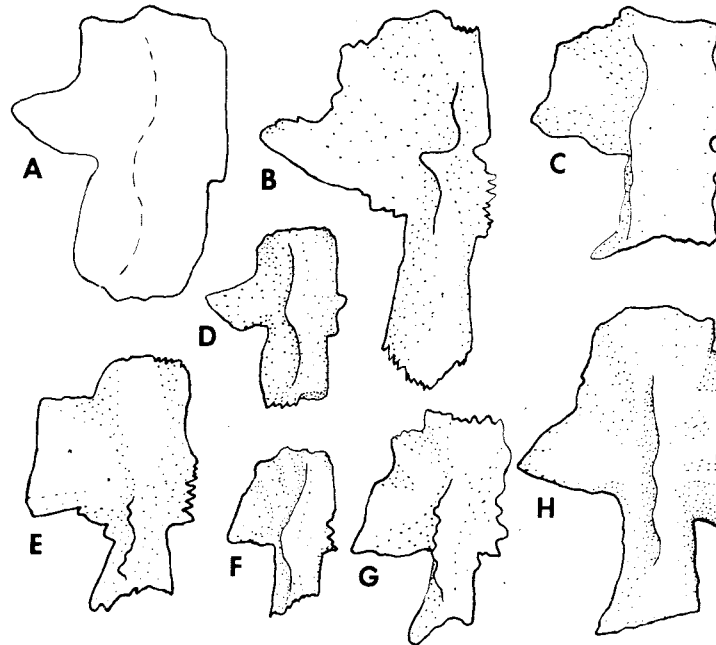


Figure 5. Comparison of catostomid left frontal bones, dorsal aspect. A. cf. *Amyzon*, UMMP V56341, Ochoco Pass locality, Oregon, X1.7. B. *Ictiobus bubalus*, uncat. spec., Texas, est. SL350mm, X1.5. C. *Cycleptus elongatus*, UMMZ 176973-S, SL 404mm, Texas, X1.5. D. *Amyzon* sp., NMC 1686, est. SL 185mm, Eocene Horsefly R. locality, Brit. Col. X1.8. E. *Catostomus comersoni*, UMMZ 160983, SL 135mm, Ky., X1.8. F. *Myxocyprinus asiaticus*, AMNH 11629, SL 59mm, China, X5.4. G. *Minytrema melanops*, UMMZ 179906, SL 206mm, Ky., X1.5. H. *Amyzon*, sp., USNM 4085 and 5508, est. SL 190mm, Oligocene, Florissant, Colo., X2.2.

Green River Formation or from the Florissant Lake Beds, although the other three families have been reported from the latter. Suckers are unknown in the Green River shales. At the Eocene Horsefly River locality in British Columbia and the Oligocene lake shales near Grant, Montana, a fossil mooneye has been found along with suckers and a bowfin. Catfish have not been discovered at these two localities as yet. The Eocene Horsefly River hiodontid may be equivalent to *Eohiodon rosei* from the Tranquille beds at Kamloops Lake, British Columbia (Cavender, 1966).

As more collecting is done at the Ochoco Pass locality, new elements in the fish fauna will probably appear. One of the scales (UMMP V56373) that has not been identified suggests that a cyprinid might have been present. Determination is difficult because *Amyzon* scales early in development can look similar to it. This scale is very small (4mm long) with a basal focus, no visible basal radii, about a dozen apical radii (5 of which are primary) and the scale has lateral basal corners. It resembles scales of *Richardsonius balteatus*. The oldest North American cyprinids now known are from the basal part (Bridge Creek flora horizon) of the John Day Formation in Oregon. A potassium-argon date of this stratigraphic horizon has been determined as 31.1 million years (Evernden and others, 1964).

Three of the above families mentioned, the Amiidae, Hiodontidae, and Catostomidae, are considered by Darlington (1957) as primary freshwater groups which are today restricted to fresh water and apparently have been thus confined through much or all of their evolutionary history. Since the catfish has not been definitely assigned to a specific family, it does not provide substantial evidence for a freshwater habitat, although catfishes today live predominantly in fresh water. Some members of the marine catfish family, Ariidae, do inhabit the lower parts of freshwater streams along the tropical coasts of Central America (Miller, 1966). Skeletal evidence, however, does not indicate that the Ochoco Pass catfish(es) is an ariid. A more probable affinity is with the Bagridae or Ictaluridae, both freshwater families according to Darlington (1957). Freshwater catfishes have a fossil record throughout most of the Cenozoic in western North America (John Lundberg, oral communication, 1967), and when this record is compared with that of some of the other freshwater families, it stands out as a fairly good one. Eocene catfish fossils representing a number of different families have been reported from Europe, Africa, Asia, South America, and (Oligocene) Australia, as well as North America (Romer, 1966). It is apparent that by early Tertiary time, the evolutionary history of siluroids was already quite complicated.

The fossil hiodontid scales from the Ochoco Pass locality vary from 3mm to 7mm in length. In Recent *Hiodon*, a similar size range can be found on very small to large juveniles up to 200 mm SL. Two living species, *Hiodon tergisus* and *H. alosoides*, and an extinct middle Eocene species, *Eohiodon rosei*, mentioned above (also the undescribed hiodontid species from the Grant lake shales, Montana), make up this family which is endemic to North America. The Hiodontidae have no close living relatives; they are relict fishes, survivors of an early stage of teleost evolution.

Potassium-argon dates from Eocene sediments in British Columbia containing the oldest known North American Catostomidae range from 45 to 49 million years (Rouse and Mathews, 1961). Suckers appear to be one of the major components both in numbers and species (except in the Green River fauna as stated above) of the early to middle Cenozoic freshwater faunas of western North America. The Eocene and Oligocene species known from complete specimens possess a long dorsal fin and seem to belong to or have a close relationship with the extinct genus *Amyzon*.

Of the four groups of fishes known in the Ochoco Pass fauna, only one, the Catostomidae, lives in the same area today. Hiodontids, catfishes and bowfins are not native to the Columbia River Basin (Miller, 1959). Catfish, however, are known from the Pliocene-Pleistocene "Idaho Lake" fauna, Columbia and Snake River drainage (Miller, 1965; Miller and Smith, 1967).

Fossil remains other than fish scales and bones occasionally are found at the Ochoco Pass locality. Various plant fragments occur as imprints on the shale slabs. One piece shows a single, broken beetle wing.

Since some of the scales are fragmented and all the bones are disarticulated, transportation of the remains may have taken place before burial. Stream carry into a quiet body of water which had a highly organic mud bottom is a possibility. However, partial to almost complete decomposition of dead fish (along with a large amount of plant material) near or on a lake bottom is perhaps a better explanation for this type of preservation. The evidence gathered from this study of the fish remains indicates that the Ochoco fish occupied, in life, a freshwater habitat.

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POST QUADRANGLE GEOLOGICALLY MAPPED

"Reconnaissance Geologic Map of the Post Quadrangle, Crook County, Oregon," by A. C. Waters, has just been published by the U.S. Geological Survey as Miscellaneous Geologic Investigations Map I-542. The Post quadrangle lies about 25 miles southeast of Prineville and immediately east of Eagle Rock quadrangle, a geologic map of which was issued recently by the Survey as Map I-540 (see June 1968 ORE BIN). No text accompanies the map, but the legend explains the various geologic units shown by color and pattern. Formations in the area range from Eocene Clarno to Holocene alluvium.

Map I-542 is for sale by the U.S. Geological Survey, Federal Center, Denver, Colo. 80225, for 75 cents.

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WITHDRAWAL SPARKED BY HIGH-TENSION DEMAND

Bonneville Power Administration has applied to the U.S. Bureau of Land Management for the withdrawal from all forms of appropriation under the public land laws, including the mining laws but not mineral leasing laws, of 111.51 acres of land in northwestern Umatilla County. Bonneville plans to construct a substation on the site if the withdrawal is approved.

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